

# Remedial Investigation of the Uplands Environment

## Former Rayonier Pulp Mill Port Angeles, WA

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Southwest Regional Office



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# Agenda

- ❑ **Background information on the cleanup law**
  - ❑ **Model Toxics Control Act cleanup process**
  - ❑ **Steps in the Rayonier Cleanup Process**
- ❑ **Public Review Period**
- ❑ **The Uplands Remedial Investigation Report**
  - ❑ **Upland Soils**
  - ❑ **Ennis Creek Sediments**
  - ❑ **Groundwater**
- ❑ **Public Comment Session**



# The Model Toxics Control Act

- ❑ **Washington State's cleanup law**
- ❑ **Passed as Initiative 97 in 1988**
- ❑ **Drafted by environmental groups**
- ❑ **Based on the federal Superfund law**
- ❑ **Authors wanted an open process that would address concerns with federal cleanups of the time**
- ❑ **Cleanup regulation issued in 1989**
- ❑ **Major revision to regulation in 2001**



# Steps in the Rayonier Cleanup Process

- ❑ Establish Administrative Framework
- ❑ Remedial Investigations ← We Are Here
- ❑ Risk Assessment
- ❑ Feasibility Study
- ❑ Selection of cleanup action
- ❑ Cleanup



# Public Review Period

- **Draft Reports**
  - **Remedial Investigation of the Uplands Environment (Uplands RI Report)**
  - **Ecology Addendum to RI**
  - **Terrestrial Ecological Evaluation**
- **Issued October 18**
- **Public Review – October 18 through December 1**



# The Uplands RI Report

- **Purpose:**
  - **Identify nature and extent of contaminants**
  - **Develop data for use in Risk Assessment, Feasibility Study**
  - **Evaluate data from previous studies and mill cleanup actions**



# The Uplands RI Report

- **Previous studies and mill cleanup actions**
  - **EPA Expanded Site Investigation (ESI) (1998)**
  - **Groundwater Monitoring (1993, 1997, 2001, 2002)**
  - **Finishing Room / Ennis Creek Actions (1991, 1993, 1998, 2002)**
  - **Former Fuel Oil Tank #2 Action (1993, 2002)**
  - **Hog Fuel Pile (1991, 2001)**
  - **Former Machine Shop (2002)**
  - **Spent Sulfite Liquor Lagoon (2001)**



# The Uplands RI Report

## *EPA Expanded Site Investigation*

- **During ESI, EPA collected:**
  - **90 surface samples and 56 subsurface samples from 96 locations on the mill property**
  - **21 surface samples from 12 locations nearby the mill property**
  - **3 surface samples from 3 locations about 5-10 miles from the mill property**



# The Uplands RI Report

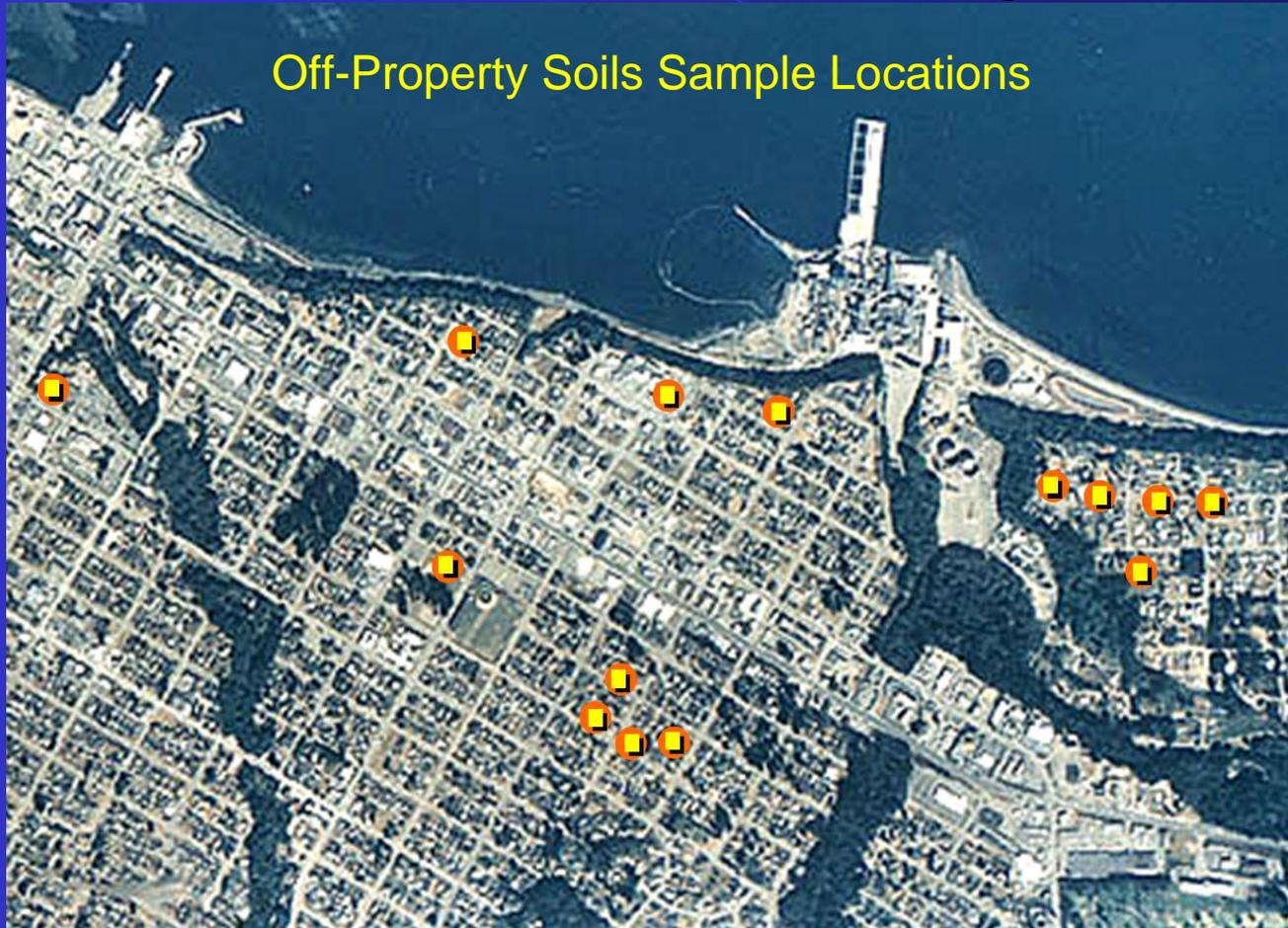
## *EPA Expanded Site Investigation*

- **ESI soil samples were analyzed for 167 chemicals, including:**
  - **Metals**
  - **Volatile organic compounds**
  - **Semivolatile organic compounds**
  - **Pesticides**
  - **PCBs**
  - **PAHs**
  - **Dioxins and furans**



# The Uplands RI Report

## *EPA Expanded Site Investigation*



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# The Uplands RI Report

## *Scope of Investigation*

- **Uplands soils**
  - **Sampling on the mill property**
  - **Evaluation of ESI off-site soils data to guide additional soils sampling off-site**
- **Sampling of groundwater on the mill property**
- **Ennis Creek sediment sampling**



# The Uplands RI Report

## *Uplands Soils*

- ❑ Most sampling locations on mill property were based on ESI results, and were placed to:
  - ❑ Resample ESI sampling locations where exceedences of cleanup levels were found
  - ❑ Define areas around ESI sampling locations where exceedences of cleanup levels were found
  - ❑ Fill gaps in coverage from ESI
  - ❑ Provide data for assessment of risks to wildlife



# The Uplands RI Report

## *Uplands Soils*

- **Sampling program for soils:**
  - **45 surface and 40 subsurface samples at 43 locations on the mill property**
  - **15 samples at 15 locations from the biologically active layer for assessment of risks to wildlife**
  - **8 samples at 8 locations of earthworms and plants for assessment of risks to wildlife**



# The Uplands RI Report

## *Uplands Soils*

- **Sampling included analyses for:**
  - **Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs)**
  - **Polychlorinated biphenyls (PCBs)**
  - **Polycyclic aromatic hydrocarbons (PAHs)**
  - **Pentachlorophenol**
  - **Petroleum hydrocarbons**
  - **Selected metals**



# The Uplands RI Report

## Soil Sampling Locations – Mill Site



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# The Uplands RI Report

## *Soil Sampling Locations – East Side of the Site*



# The Uplands RI Report

## *Uplands Soils – Points of Comparison*

- ❑ **Risk-based Criteria**
  - ❑ **MTCA unrestricted and industrial use criteria**
  - ❑ **EPA Preliminary Remediation Goals**
- ❑ **Background Concentrations**
  - ❑ **Metals – 1994 Ecology Study**
- ❑ **Globally Distributed Substances**



# The Uplands RI Report

## *Uplands Soils – Sampling Groups*

- ❑ **Bone Yard**
- ❑ **Chlorine Dioxide Generator / Pre-Fab Building**
- ❑ **Log Yard**
- ❑ **Wood Mill**
- ❑ **Spent Sulfite Liquor Lagoon**
- ❑ **Ecological Samples**
- ❑ **Main Process Area**
- ❑ **East Side of the Site**
- ❑ **Off-property Residential Soils**



# The Uplands RI Report

## *Uplands Soils – Bone Yard*

- ❑ Area was used to store equipment taken out of service but which might be reused
- ❑ Possible sources included equipment leaks, spills and washdown releases
- ❑ ESI detected arsenic and PAHs above the unrestricted criteria
- ❑ RI detected lower concentrations of arsenic above the unrestricted criterion, but below regional background
- ❑ RI attributes PAHs to stack emissions and addresses them as part of the East Side soils



# The Uplands RI Report

## *Uplands Soils – Chlorine Dioxide Generator/Prefab Building*

- ❑ Area was used for production of chlorine used in pulp bleaching, storage, and a parking lot
- ❑ Possible sources included equipment leaks and spills
- ❑ ESI detected arsenic and single detections of copper and chrysene above the unrestricted criteria
- ❑ ESI arsenic detections were above unrestricted criteria, but below regional background
- ❑ ESI chrysene detection attributed to asphalt material in sample
- ❑ RI did not confirm elevated copper at the location of the ESI exceedence



# The Uplands RI Report

## *Uplands Soils – Spent Sulfite Liquor Lagoon*

- ❑ **Area was used for temporary storage of SSL prior to burning it in the recovery boiler**
- ❑ **Possible sources included adsorption into soil liner, leaks and spills**
- ❑ **Area was not sampled during ESI**
- ❑ **RI detected arsenic in surface and subsurface at levels below regional background**
- ❑ **RI attributes PCDD/Fs detected in surface soil samples to stack emissions and addresses them as part of the East Side soils**



# The Uplands RI Report

## *Uplands Soils – Wood Mill*

- ❑ Area was used to grind logs into chips and hog fuel
- ❑ Possible sources included hydraulic fluid leaks and spills
- ❑ Area was not sampled during ESI
- ❑ RI detected heavy oil residuals above industrial criterion in surface and subsurface samples
- ❑ Arsenic, PCDD/Fs, PAHS and one PCB exceeded unrestricted criteria in surface and subsurface samples
- ❑ Arsenic also exceeded regional background



# The Uplands RI Report

## *Uplands Soils – Log Yard*

- ❑ **Area was used to store logs awaiting processing and temporary storage of boiler ash**
- ❑ **ESI detected lead above industrial criterion**
- ❑ **Arsenic and PCDD/Fs were detected above unrestricted criteria**
- ❑ **Arsenic detections exceeded regional background in two samples**



# The Uplands RI Report

## *Uplands Soils – Log Yard*

- ❑ RI detected PAHs above industrial criterion at one location
- ❑ Arsenic, lead, PCDD/Fs, PAHS and petroleum residuals above unrestricted criteria in surface and subsurface samples
- ❑ Many RI exceedences are associated with location LY21



# The Uplands RI Report

## *Uplands Soils – Ecological Samples*

- ❑ **Sampling of surface soils to support Terrestrial Ecological Evaluation**
- ❑ **Analysis for metals and PCDD/Fs**
- ❑ **Arsenic detected above unrestricted criterion, but at or below regional background**
- ❑ **Exceedence of PCDD/Fs unrestricted criteria at several locations**
- ❑ **No exceedences of industrial criteria**



# The Uplands RI Report

## *Uplands Soils – Main Process Area*

- ❑ **Area comprised most of the industrial operations of the mill**
- ❑ **ESI detected arsenic above the industrial criterion at five locations**
- ❑ **RI detected arsenic above the unrestricted criterion, but not above the industrial criterion, including resampling at or near ESI locations where industrial criterion had been exceeded**



# The Uplands RI Report

## *Uplands Soils – Main Process Area*

- ❑ **ESI identified three locations where lead exceeded the RI industrial screening level**
- ❑ **RI resampling at these locations found lower lead concentrations – two below the unrestricted criterion, one above, but below the industrial criterion and the RI screening level**
- ❑ **Several other locations exceeded the unrestricted criterion for lead, but not the industrial criterion**
- ❑ **Sporadic detections of several metals above unrestricted criterion attributed to metallic debris in fill or unknown localized occurrences**



# The Uplands RI Report

## *Uplands Soils – Main Process Area*

- ❑ **ESI detection limits for PAHs were above the unrestricted criterion**
- ❑ **ESI and RI did not detect cPAHs above industrial criterion**
- ❑ **Several RI samples across the area exceeded the unrestricted criterion**
- ❑ **Several single ESI and RI detections of other organic chemicals are attributed to probable inclusion of foreign material in samples**



# The Uplands RI Report

## *Uplands Soils – Main Process Area*

- ❑ **ESI detected PCDD/Fs above industrial criteria in surface soils at one location**
- ❑ **RI sampling did not confirm that exceedence**
- ❑ **ESI and RI detected PCDD/Fs above unrestricted criteria in surface soils at 23 locations across the area**
- ❑ **RI detected PCDD/Fs above unrestricted criteria in subsurface soils at five locations across the area**
- ❑ **Statistically significant difference in surface and subsurface PCDD/F concentrations supports aerial deposition as source**



# The Uplands RI Report

## *Uplands Soils – East Side of The Site*

- ❑ Focus on possible aerial deposition of stack emissions on surface soils
- ❑ Contaminants associated with stack emissions include metals, PAHs, PCDD/Fs
- ❑ Metals concentrations do not appear to be the product of stack emissions
- ❑ PAHs exceeded the unrestricted criterion in two samples
- ❑ PCDD/Fs exceeded unrestricted criteria at two locations
- ❑ No exceedences of any industrial criteria



# The Uplands RI Report

## *Uplands Soils – Off-Property Residential Soils*

- **RI Management Plan - Evaluation in two phases**
  - **Phase 1 - Analysis of existing data**
    - **Computer modeling of dispersion of particulates emitted from mill stacks**
    - **Assessment of ESI off-site data for coverage of areas where particulates touched down**
  - **Phase 2 - Additional soil sampling and analysis to fill gaps identified in Phase 1**



# The Uplands RI Report

## *Uplands Soils – Off-Property Residential Soils*

- **Phase 1 - Analysis of existing data**
  - **Several sources of uncertainty limit use of approach**
    - **Suitability of meteorological data to drive deposition model**
    - **Potential for other unevaluated historic sources affecting results**
  - **Approach was deemed to be inconclusive for guiding additional sampling**
  
- **Phase 2 - Additional soil sampling and analysis**
  - **Sampling strategy will be developed in consultation with state and local agencies**



# The Uplands RI Report

## *Uplands Soils – Off-Property Residential Soils*

- ❑ **ESI sampling detected PCDD/Fs present in two locations above unrestricted criteria**
- ❑ **Other chemicals detected in the ESI sampling occur sporadically and are distributed over the sampled areas without patterns that would be consistent with deposition from mill stack emissions**



# The Uplands RI Report

## *Ennis Creek Sediments*

- ❑ **ESI sampling collected eight freshwater sediment samples**
- ❑ **Three of these were collected in areas above the mill and were considered to be reference samples**
- ❑ **RI sampling collected one additional freshwater sediment sample**
- ❑ **Chemical concentrations in ESI and RI samples from the reach through the formerly active area of the mill do not differ substantially from the reference samples**
- ❑ **No exceedences of freshwater sediment quality benchmarks were detected**





## Approximate Ennis Creek Sediment Sample Locations

-  EPA ESI Sampling Locations
-  RI/FS Sampling Locations



## Former Rayonier Mill Site Sediment Sampling Locations

# The Uplands RI Report

## *Groundwater*

- ❑ **Several previous groundwater investigations have been conducted on the mill property**
  - ❑ **EPA Expanded Site Investigation**
  - ❑ **Assessments of groundwater impacts at specific sources (Finishing Room, Fuel Oil Tanks)**
  - ❑ **Ongoing site-wide groundwater sampling**



# The Uplands RI Report

## *Groundwater*

- **RI evaluates several parameters**
  - **Groundwater elevations, gradient, velocity**
  - **Hydraulic conductivity**
  - **Tidal influence**
  - **Aquifer characteristics**
  - **Groundwater analytical data**
  - **Analytical methods capable of indicating concentrations at or below applicable criteria**



# The Uplands RI Report

## *Groundwater – Hydrologic Evaluation*

- ❑ Groundwater elevations show a typical seasonal response to rainfall patterns
- ❑ Gradients in the northern portion of the mill site are influenced by tidal stage
- ❑ Tidal influence from point to point across the site varies significantly due to the varied nature of the fill material
- ❑ Groundwater discharge from the site is estimated to range from 24 cubic feet per day to 6444 cubic feet per day
- ❑ The average groundwater discharge is estimated to be 1249 cubic feet per day



# The Uplands RI Report

## *Groundwater – Sampling & Analysis*

- **Sampling included analyses for:**
  - **Selected metals**
  - **Volatile organic compounds**
  - **Semivolatile organic compounds**
  - **Chlorinated pesticides**
  - **Petroleum hydrocarbons**
  - **Cation/anion balance**
  - **Conventional groundwater parameters**
  - **Field parameters**



# The Uplands RI Report

## *Groundwater – Sampling Locations*



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# The Uplands RI Report

## *Groundwater – Points of Comparison*

- ❑ **Groundwater not considered as potential drinking water source**
- ❑ **Screening criteria selected on potential effects of discharge of groundwater to surface water**
  - ❑ **Protection of human health**
    - ❑ **MTCA Surface Water Criteria**
    - ❑ **National Toxics Rule**
    - ❑ **National Water Quality Criteria**
  - ❑ **Protection of aquatic organisms**
    - ❑ **Ambient Water Quality Criteria**
    - ❑ **National Toxics Rule**



# The Uplands RI Report

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    - ❑ **National Toxics Rule**



# The Uplands RI Report

## *Groundwater – Chemical Analytical Data*

- **Volatile Organic Compounds**
  - **Acetone, ethylbenzene, xylenes, toluene were detected in more than one location**
  - **No VOCs were detected above screening criteria**
  - **No exceedences of screening criteria identified in review of historic groundwater data**



# The Uplands RI Report

## *Groundwater – Chemical Analytical Data*

- **Semivolatile Organic Compounds**
  - **Phthalates were detected at most locations at levels below screening criteria**
  - **2,4,6-trichlorophenol, pentachlorophenol, benzo(a)anthracene, and chrysene were detected above criteria at three locations**
  - **Exceedences of criteria for pentachlorophenol, bis(2-ethylhexyl)phthalate (BEHP), benzo(a)anthracene, benzo(a)pyrene (BaP), chrysene were identified in review of historic groundwater data**



# The Uplands RI Report

## *Groundwater – Chemical Analytical Data*

- ❑ **Semivolatile Organic Compounds**
  - ❑ **Subsequent sampling events did not show exceedences of criteria for BEHP and BaP at the previously-identified locations**
  - ❑ **Total petroleum hydrocarbon residuals were identified at levels above criteria in one well in 2001**
  - ❑ **2002 interim action removed the well and surrounding soils**
  - ❑ **Nearby wells have shown no exceedences of criteria for petroleum residuals**



# The Uplands RI Report

## *Groundwater – Chemical Analytical Data*

### □ **Metals**

- **Screening criteria were exceeded for dissolved forms of five metals at several locations - arsenic, chromium, copper, nickel, and mercury**
- **Screening criteria were exceeded for total lead at one RI location**
- **Historic groundwater data indicates that these same metals have exceeded screening criteria in the past**
- **Selenium has exceeded criteria in the past but did not exceed criteria in the RI sampling**



# The Uplands RI Report

## *Groundwater – Chemical Analytical Data*

### □ Pesticides and PCBs

- RI sampling identified seven pesticides exceeding screening criteria:  
4,4'-DDD, 4,4'-DDE, 4,4'-DDT,  $\alpha$ -chlordane, dieldrin, endrin, heptachlor
- Five pesticides were analyzed with detection limits above criteria:  
aldrin, heptachlor epoxide, toxaphene,  $\alpha$ -BHC, endosulfan II
- Aroclor 1260 and total PCBs were detected above criteria in one RI location



# The Uplands RI Report

## *Groundwater – Chemical Analytical Data*

- **Pesticides and PCBs**
  - **Aroclor 1260 was also detected in same location in previous sampling**
  - **Review of historic groundwater data of limited value due to detection limits for pesticides above screening criteria**



# The Uplands RI Report

## *Groundwater – Chemical Analytical Data*

- **Conventional Parameters**
  - **Ammonia as nitrate exceeded screening criteria at seven locations in RI sampling**
  - **Review of historical data shows several exceedences of criteria for nitrate**



# Ecology Addendum the RI

## *Purpose*

- ❑ To provide an evaluation of PCDD/Fs total toxicity equivalent concentrations from ESI and RI data, using the methodology which has typically been used for evaluation of dioxins in the MTCA framework since the 2001 revision to the cleanup regulation
- ❑ To provide calculations of PCDD/F total toxicity equivalent concentrations from ESI and RI data, using the methodology which Ecology is proposing in an amendment to the MTCA cleanup regulation



# The Terrestrial Ecological Evaluation

## *Purpose*

- ❑ To determine whether a release of hazardous substances to soil may pose a threat to the terrestrial environment
- ❑ To characterize existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil
- ❑ To produce information to be used in developing and evaluating cleanup action alternatives and in selecting a cleanup action



# The Terrestrial Ecological Evaluation

## *Four Areas of Ecological Exposure On Site*

- ❑ **Industrially developed areas – lower current habitat value**
  - ❑ **East Mill Area**
  - ❑ **West Mill Area**
- ❑ **Relatively undisturbed areas– higher current habitat value**
  - ❑ **Marine Bluffs**
  - ❑ **Ennis Creek**



# The Terrestrial Ecological Evaluation

## *Combinations of Areas, Uses, Exposure Scenarios*

- ❑ **West Mill (0-6 feet): current use - protection of wildlife**
- ❑ **West Mill (0-15 feet): future use - protection of wildlife**
- ❑ **East Mill (0-6 feet): current use - protection of plants, soil biota, wildlife**
- ❑ **East Mill (0-15 feet): future use - protection of plants, soil biota, wildlife**
- ❑ **Marine Bluffs: current and future use – protection of plants, soil biota, wildlife**
- ❑ **Ennis Creek : current and future use – protection of plants, soil biota, wildlife**



# The Terrestrial Ecological Evaluation

## *Screening Criteria*

- ❑ Screening compares maximum concentrations at point of exposure to indicator soil concentrations (ISCs)
- ❑ ISCs are concentrations below which threats to plants, soil biota or wildlife are considered insignificant
- ❑ MTCA cleanup regulation provides ISC values
- ❑ MTCA cleanup regulation provides target species at lower levels of food web as most critically-exposed to soil contaminants
- ❑ Four target species used in this evaluation – shrew, vole, robin, goose



# The Terrestrial Ecological Evaluation

## *Results of Screening*

- Chemicals of potential ecological concern (COPECs):
  - PCDD/Fs
  - PCBs
  - Antimony
  - Chromium
  - Copper
  - Lead
  - Mercury
  - Nickel
  - Silver
  - Zinc



# The Terrestrial Ecological Evaluation

## *Conclusions – Plants and Soil Biota*

- ❑ Exposures of plants to COPECs in soil were below ISC and toxicity threshold levels in each exposure area of the site
- ❑ Exposures of soil biota to COPECs in soil were below the lowest levels at which adverse effects have been observed in earthworms in each exposure area of the site



# The Terrestrial Ecological Evaluation

## *Conclusions – Wildlife*

- ❑ For exposures to soils mixed over the 0-15 feet depth interval, one dioxin congener poses a threat to one target species - the shrew
- ❑ For exposures to soils mixed over the 0-6 feet depth interval, one dioxin congener poses a threat to the shrew and zinc poses a threat to robins



# The Terrestrial Ecological Evaluation

## *Conclusions – Wildlife*

- ❑ For exposures to soil from the 0-6 inch depth interval:
  - ❑ Total PCBs presents a threat to the shrew
  - ❑ 1,2,3,4,6,7,8-heptachlorodibenzo(p)dioxin presents a threat to the shrew
  - ❑ Antimony presents a threat to the vole
  - ❑ Mercury present a threat to the shrew, the robin and the goose
  - ❑ Zinc presents a threat to the shrew and the robin



# Ecology Welcomes Your Comments

Comments may be submitted through December 1

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